

Amendments to the Claims

This listing of claims will replace all prior versions of claims in the application:

Listing of Claims

1. (Currently amended) A process for reforming an alcohol, the process comprising:

contacting a feed gas mixture comprising an alcohol with a reforming catalyst ~~comprising copper at the surface of a metal sponge supporting structure~~ to produce a reforming product mixture comprising hydrogen, the reforming catalyst comprising a metal sponge supporting structure and a copper coating at least partially covering the surface of the metal sponge supporting structure, wherein the metal sponge supporting structure is prepared by a process comprising leaching aluminum from an alloy comprising aluminum and a base metal.

2. (Original) A process as set forth in claim 1, wherein the feed gas mixture comprises a primary alcohol selected from the group consisting of methanol, ethanol and mixtures thereof.

3. (Original) A process as set forth in claim 2, wherein the process further comprises introducing hydrogen from the reforming product mixture and oxygen into a fuel cell to produce electric power.

4. (Original) A process as set forth in claim 1, wherein the reforming catalyst has a surface area of from about 10 m²/g to about 100 m²/g as measured by the Brunauer-Emmett-Teller method.

5. (Original) A process as set forth in claim 4, wherein the reforming catalyst has a surface area of from about 25 m²/g to about 100 m²/g as measured by the Brunauer-Emmett-Teller method.

6. (Original) A process as set forth in claim 5, wherein the reforming catalyst has a surface area of from about 30 m²/g to about 80 m²/g as measured by the Brunauer-Emmett-Teller method.

7. (Original) A process as set forth in claim 1, wherein the reforming catalyst comprises at least about 10% by weight copper.

8. (Original) A process as set forth in claim 1, wherein the reforming catalyst comprises from about 10% to about 90% by weight copper.

9. (Original) A process as set forth in claim 1, wherein the metal sponge supporting structure of the reforming catalyst has a surface area of at least about 10 m²/g as measured by the Brunauer-Emmett-Teller method.

10. (Original) A process as set forth in claim 9, wherein the metal sponge supporting structure of the reforming catalyst has a surface area of at least about 50 m²/g as measured by the Brunauer-Emmett-Teller method.

11. (Original) A process as set forth in claim 10, wherein the metal sponge supporting structure of the reforming catalyst

has a surface area of at least about 70 m²/g as measured by the Brunauer-Emmett-Teller method.

12. (Original) A process as set forth in claim 9, wherein the metal sponge supporting structure comprises nickel.

13. (Original) A process as set forth in claim 12, wherein the metal sponge supporting structure comprises at least about 50% by weight nickel.

14. (Original) A process as set forth in claim 13, wherein the metal sponge supporting structure comprises at least about 85% by weight nickel.

15. (Original) A process as set forth in claim 12, wherein the reforming catalyst comprises from about 10% to about 80% by weight copper.

16. (Original) A process as set forth in claim 15, wherein the reforming catalyst comprises from about 20% to about 45% by weight copper.

17. (Original) A process as set forth in claim 12, wherein the reforming catalyst comprises from about 5 to about 100 $\mu\text{mol/g}$ of nickel at the surface of said catalyst.

18. (Original) A process as set forth in claim 17, wherein the reforming catalyst comprises from about 10 to about 80 $\mu\text{mol/g}$ of nickel at the surface of said catalyst.

19. (Original) A process as set forth in claim 18, wherein the reforming catalyst comprises from about 15 to about 75 $\mu\text{mol/g}$ of nickel at the surface of said catalyst.

20. (Original) A process as set forth in claim 12, wherein the feed gas mixture comprises a primary alcohol selected from the group consisting of methanol, ethanol and mixtures thereof.

21. (Original) A process as set forth in claim 12, wherein the process further comprises introducing hydrogen from the reforming product mixture and oxygen into a fuel cell to produce electric power.

22. (Original) A process as set forth in claim 1, wherein said feed gas mixture is contacted with said reforming catalyst at a temperature below about 400°C.

23. (Original) A process as set forth in claim 1, wherein said feed gas mixture is contacted with said reforming catalyst at a temperature of from about 200°C to about 375°C.

24. (Original) A process as set forth in claim 23, wherein said feed gas mixture is contacted with said reforming catalyst at a temperature of from about 250°C to about 325°C.

25. (Original) A process as set forth in claim 1, wherein the reforming catalyst is incorporated onto the surface of a pellet or a monolith substrate.

26. (Original) A process as set forth in claim 25, wherein the reforming catalyst comprises a nickel sponge supporting structure.

27. (Currently amended) A process for reforming ethanol, the process comprising contacting a feed gas mixture comprising ethanol with a reforming catalyst at a temperature below about 400°C to produce a reforming product mixture comprising hydrogen, said reforming catalyst comprising copper at the surface of a metal supporting structure.

28. (Original) A process as set forth in claim 27, wherein said feed gas mixture is contacted with said reforming catalyst at a temperature of from about 250°C to about 300°C.

29. (Original) A process as set forth in claim 27, wherein the reforming catalyst has a thermal conductivity at 300K of at least about 50 W/m·K.

30. (Original) A process as set forth in claim 29, wherein the reforming catalyst has a thermal conductivity at 300K of at least about 70 W/m·K.

31. (Original) A process as set forth in claim 30, wherein the reforming catalyst has a thermal conductivity at 300K of at least about 90 W/m·K.

32. (Original) A process as set forth in claim 27, wherein the process further comprises introducing hydrogen from the reforming product mixture and oxygen into a fuel cell to produce electric power.

33. (Original) A process as set forth in claim 27, wherein the reforming catalyst has a surface area of from about 10 m²/g to about 100 m²/g as measured by the Brunauer-Emmett-Teller method.

34. (Original) A process as set forth in claim 33, wherein the reforming catalyst has a surface area of from about 25 m²/g to about 100 m²/g as measured by the Brunauer-Emmett-Teller method.

35. (Original) A process as set forth in claim 34, wherein the reforming catalyst has a surface area of from about 30 m²/g to about 80 m²/g as measured by the Brunauer-Emmett-Teller method.

36. (Original) A process as set forth in claim 27, wherein the reforming catalyst comprises at least about 10% by weight copper.

37. (Original) A process as set forth in claim 36, wherein the reforming catalyst comprises from about 10% to about 90% by weight copper.

38. (Original) A process as set forth in claim 27, wherein the metal supporting structure comprises a metal sponge.

39. (Original) A process as set forth in claim 38, wherein the metal sponge supporting structure of the reforming catalyst has a surface area of at least about 10 m²/g as measured by the Brunauer-Emmett-Teller method.

40. (Original) A process as set forth in claim 39, wherein the metal sponge supporting structure of the reforming catalyst has a surface area of at least about $50 \text{ m}^2/\text{g}$ as measured by the Brunauer-Emmett-Teller method.

41. (Original) A process as set forth in claim 40, wherein the metal sponge supporting structure of the reforming catalyst has a surface area of at least about $70 \text{ m}^2/\text{g}$ as measured by the Brunauer-Emmett-Teller method.

42. (Original) A process as set forth in claim 38, wherein the metal sponge supporting structure comprises nickel.

43. (Original) A process as set forth in claim 42, wherein the metal sponge supporting structure comprises at least about 50% by weight nickel.

44. (Original) A process as set forth in claim 43, wherein the metal sponge supporting structure comprises at least about 85% by weight nickel.

45. (Original) A process as set forth in claim 42, wherein the reforming catalyst comprises from about 10% to about 80% by weight copper.

46. (Original) A process as set forth in claim 45, wherein the reforming catalyst comprises from about 20% to about 45% by weight copper.

47. (Original) A process as set forth in claim 42, wherein the reforming catalyst comprises from about 5 to about 100 $\mu\text{mol/g}$ of nickel at the surface of said catalyst.

48. (Original) A process as set forth in claim 47, wherein the reforming catalyst comprises from about 10 to about 80 $\mu\text{mol/g}$ of nickel at the surface of said catalyst.

49. (Original) A process as set forth in claim 48, wherein the reforming catalyst comprises from about 15 to about 75 $\mu\text{mol/g}$ of nickel at the surface of said catalyst.

50. (Original) A process as set forth in claim 42, wherein the process further comprises introducing hydrogen from the reforming product mixture and oxygen into a fuel cell to produce electric power.

51. (Original) A process as set forth in claim 27, wherein the reforming catalyst is incorporated onto the surface of a pellet or a monolith substrate.

52. (Original) A process as set forth in claim 51, wherein the reforming catalyst comprises a nickel sponge supporting structure.

53. (Currently Amended) A process for producing electric power from a fuel cell, the process comprising:

contacting a feed gas mixture comprising ethanol with a dehydrogenation catalyst at a temperature below about 400°C in a dehydrogenation reaction zone to produce a product mixture

comprising hydrogen, wherein said dehydrogenation catalyst comprises copper at the surface of a metal supporting structure; introducing hydrogen from the product mixture and oxygen into a fuel cell to produce electric power and a fuel cell effluent comprising methane; introducing the fuel cell effluent and oxygen into a combustion chamber; combusting the fuel cell effluent in the combustion chamber.

54. (Original) A process as set forth in claim 53, wherein the feed gas mixture further comprises water.

55. (Original) A process as set forth in claim 54, wherein the dehydrogenation reaction zone further comprises a water-gas shift catalyst effective for catalyzing the water-gas shift reaction between carbon monoxide produced by the dehydrogenation of ethanol and water to form carbon dioxide and hydrogen.

56. (Original) A process as set forth in claim 55, wherein the water-gas shift catalyst is separate from the dehydrogenation catalyst.

57. (Original) A process as set forth in claim 53, wherein the process further comprises transferring the heat of combustion produced in the combustion chamber to the dehydrogenation reaction zone.

58. (Original) A process as set forth in claim 53, wherein the process further comprises capturing the energy of combustion

for the generation of mechanical and/or additional electric power

59. (Original) A process as set forth in claim 58, wherein the energy of combustion from said combustion chamber is used to drive a generator for the production of additional electric power.

60. (Original) A process as set forth in claim 58, wherein the dehydrogenation zone and the combustion chamber are part of a vehicular power system and the electric power and/or the mechanical power produced is used to drive the vehicle.

61. (Original) A process as set forth in claim 53 further comprising introducing a separate cold start fuel source into the combustion chamber and combusting the separate cold start fuel source in the presence of oxygen.

62. (Original) A process as set forth in claim 61, wherein the fuel cell effluent and the cold start fuel source are introduced into a combustion chamber of a flexible fuel source internal combustion engine capable of combusting methane and/or the separate cold start fuel source.

63. (Original) A process as set forth in claim 62, wherein the dehydrogenation zone and the flexible fuel source internal combustion engine are part of a vehicular power system, the process further comprising capturing the energy of combustion for the generation of mechanical and/or additional electric power and using said mechanical power and/or said electric power to drive the vehicle.

64. (Cancelled)

65. (Currently Amended) A process as set forth in claim 53 ~~[[64]]~~, wherein said feed gas mixture is contacted with said dehydrogenation catalyst at a temperature of from about 250°C to about 300°C.

66. (Original) A process as set forth in claim 53, wherein the dehydrogenation catalyst has a thermal conductivity at 300K of at least about 50 W/m²K.

67. (Original) A process as set forth in claim 66, wherein the dehydrogenation catalyst has a thermal conductivity at 300K of at least about 70 W/m²K.

68. (Original) A process as set forth in claim 67, wherein the dehydrogenation catalyst has a thermal conductivity at 300K of at least about 90 W/m²K.

69. (Original) A process as set forth in claim 53, wherein the dehydrogenation catalyst has a surface area of from about 10 m²/g to about 100 m²/g as measured by the Brunauer-Emmett-Teller method.

70. (Original) A process as set forth in claim 69, wherein the dehydrogenation catalyst has a surface area of from about 25 m²/g to about 100 m²/g as measured by the Brunauer-Emmett-Teller method.

71. (Original) A process as set forth in claim 70, wherein the dehydrogenation catalyst has a surface area of from about 30 m²/g to about 80 m²/g as measured by the Brunauer-Emmett-Teller method.

72. (Original) A process as set forth in claim 53, wherein the dehydrogenation catalyst comprises at least about 10% by weight copper.

73. (Original) A process as set forth in claim 72, wherein the dehydrogenation catalyst comprises from about 10% to about 90% by weight copper.

74. (Original) A process as set forth in claim 53, wherein the metal supporting structure of the dehydrogenation catalyst comprises a metal sponge.

75. (Original) A process as set forth in claim 74, wherein the metal sponge supporting structure of the dehydrogenation catalyst has a surface area of at least about 10 m²/g as measured by the Brunauer-Emmett-Teller method.

76. (Original) A process as set forth in claim 75, wherein the metal sponge supporting structure of the dehydrogenation catalyst has a surface area of at least about 50 m²/g as measured by the Brunauer-Emmett-Teller method.

77. (Original) A process as set forth in claim 76, wherein the metal sponge supporting structure of the dehydrogenation catalyst has a surface area of at least about 70 m²/g as measured by the Brunauer-Emmett-Teller method.

78. (Original) A process as set forth in claim 74, wherein the metal sponge supporting structure comprises nickel.

79. (Original) A process as set forth in claim 78, wherein the metal sponge supporting structure comprises at least about 50% by weight nickel.

80. (Original) A process as set forth in claim 79, wherein the metal sponge supporting structure comprises at least about 85% by weight nickel.

81. (Original) A process as set forth in claim 78, wherein the dehydrogenation catalyst comprises from about 10% to about 80% by weight copper.

82. (Original) A process as set forth in claim 81, wherein the dehydrogenation catalyst comprises from about 20% to about 45% by weight copper.

83. (Original) A process as set forth in claim 81, wherein the dehydrogenation catalyst comprises from about 5 to about 100 $\mu\text{mol/g}$ of nickel at the surface of said catalyst.

84. (Original) A process as set forth in claim 83, wherein the dehydrogenation catalyst comprises from about 10 to about 80 $\mu\text{mol/g}$ of nickel at the surface of said catalyst.

85. (Original) A process as set forth in claim 84, wherein the dehydrogenation catalyst comprises from about 15 to about 75 $\mu\text{mol/g}$ of nickel at the surface of said catalyst.

86. (Original) A process as set forth in claim 53, wherein the dehydrogenation catalyst is incorporated onto the surface of a pellet or a monolith substrate.

87. (Currently amended) A process as set forth in claim 86 [[39]], wherein the dehydrogenation catalyst comprises a nickel sponge supporting structure.

88. (New) A process as set forth in claim 1 wherein preparation of the reforming catalyst comprises depositing copper onto the metal sponge supporting structure.

89. (New) A process as set forth in claim 88 wherein copper is deposited by a method comprising electrochemical displacement reaction between a metal of the metal sponge supporting structure and copper ions.

90. (New) A process as set forth in claim 88 wherein copper is deposited by a method comprising electroless plating of copper metal on the metal sponge supporting structure.

91. (New) A process as set forth in claim 1 wherein the base metal comprises copper and/or a non-copper metal selected from the group consisting of nickel, cobalt, zinc, silver, palladium, gold, tin, iron and mixtures thereof.

92. (New) A process as set forth in claim 91 wherein the base metal comprises copper and/or a non-copper metal selected from the group consisting of nickel, cobalt and mixtures thereof.

93. (New) A process as set forth in claim 92, wherein the base metal comprises nickel.

94. (New) A process as set forth in claim 20, wherein the feed gas mixture comprises ethanol.

95. (New) A process as set forth in claim 22 wherein the reforming product mixture comprises methane.

96. (New) A process as set forth in claim 95 comprising feeding methane obtained in the reforming product mixture to an internal combustion engine.

97. (New) A process as set forth in claim 95 comprising feeding hydrogen obtained in the reforming product mixture to an internal combustion engine.

98. (New) A process as set forth in claim 27 wherein the reforming product mixture comprises methane.

99. (New) A process as set forth in claim 98 comprising feeding methane obtained in the reforming product mixture to an internal combustion engine.

100. (New) A process as set forth in claim 98 comprising feeding hydrogen obtained in the reforming product mixture to an internal combustion engine.

101. (New) A process as set forth in claim 38 wherein the metal sponge supporting structure is prepared by a process

comprising leaching aluminum from an alloy comprising aluminum and a base metal.

102. (New) A process as set forth in claim 101 wherein the base metal comprises copper and/or a non-copper metal selected from the group consisting of nickel, cobalt, zinc, silver, palladium, gold, tin, iron and mixtures thereof.

103. (New) A process as set forth in claim 102 wherein the base metal comprises copper and/or a non-copper metal selected from the group consisting of nickel, cobalt and mixtures thereof.

104. (New) A process as set forth in claim 103 wherein the base metal comprises nickel.

105. (New) A process as set forth in claim 38 wherein the reforming catalyst comprises a copper coating at least partially covering the surface of the metal sponge supporting structure.

106. (New) A process as set forth in claim 105 wherein preparation of the reforming catalyst comprises depositing copper onto the metal sponge supporting structure.

107. (New) A process as set forth in claim 106 wherein copper is deposited by a method comprising electrochemical displacement reaction between a metal of the metal sponge supporting structure and copper ions.

108. (New) A process as set forth in claim 106 wherein copper is deposited by a method comprising electroless plating of copper metal on the metal sponge supporting structure.

109. (New) A process as set forth in claim 74 wherein the metal sponge supporting structure is prepared by a process comprising leaching aluminum from an alloy comprising aluminum and a base metal.

110. (New) A process as set forth in claim 109 wherein the base metal comprises copper and/or a non-copper metal selected from the group consisting of nickel, cobalt, zinc, silver, palladium, gold, tin, iron and mixtures thereof.

111. (New) A process as set forth in claim 110 wherein the base metal comprises copper and/or a non-copper metal selected from the group consisting of nickel, cobalt and mixtures thereof.

112. (New) A process as set forth in claim 111 wherein the base metal comprises nickel.

113. (New) A process as set forth in claim 74 wherein said dehydrogenation catalyst comprises a copper coating at least partially covering the surface of the metal sponge supporting structure.

114. (New) A process as set forth in claim 113 wherein preparation of the catalyst comprises depositing copper onto the metal sponge supporting structure.

115. (New) A process as set forth in claim 114 wherein copper is deposited by a method comprising electrochemical displacement reaction between a metal of the metal sponge supporting structure and copper ions.

116. (New) A process as set forth in claim 114 wherein copper is deposited by a method comprising electroless plating of copper metal on the metal sponge supporting structure.

117. (New) A process for reforming an alcohol, the process comprising:

contacting a feed gas mixture comprising an alcohol with a reforming catalyst to produce a reforming product mixture comprising hydrogen, wherein the reforming catalyst is prepared by a process comprising depositing copper on a metal sponge supporting structure.

118. (New) A process as set forth in claim 117 wherein copper is deposited by a method comprising electrochemical displacement reaction between a metal of the metal sponge supporting structure and copper ions.

119. (New) A process as set forth in claim 117 wherein copper is deposited by a method comprising electroless plating of copper metal on the metal sponge supporting structure.

120. (New) A process as set forth in claim 117, wherein the metal sponge supporting structure comprises nickel.

121. (New) A process as set forth in claim 117, wherein the feed gas mixture comprises a primary alcohol selected from the group consisting of methanol, ethanol and mixtures thereof.

122. (New) A process as set forth in claim 121, wherein the feed gas mixture comprises ethanol.

123. (New) A process as set forth in claim 122, wherein said feed gas mixture is contacted with said reforming catalyst at a temperature below about 400°C.

124. (New) A process as set forth in claim 117 wherein the reforming product mixture comprises methane.

125. (New) A process as set forth in claim 124 comprising feeding methane obtained in the reforming product mixture to an internal combustion engine.

126. (New) A process as set forth in claim 124 comprising feeding hydrogen obtained in the reforming product mixture to an internal combustion engine.

127. (New) A process as set forth in claim 117 wherein the metal sponge supporting structure is prepared by a process comprising leaching aluminum from an alloy comprising aluminum and a base metal.

128. (New) A process as set forth in claim 127 wherein the base metal comprises copper and/or a non-copper metal selected from the group consisting of nickel, cobalt, zinc, silver, palladium, gold, tin, iron and mixtures thereof.

129. (New) A process as set forth in claim 128 wherein the base metal comprises copper and/or a non-copper metal selected from the group consisting of nickel, cobalt and mixtures thereof.

130. (New) A process as set forth in claim 129 wherein the base metal comprises nickel.